LIMITED
WRD/MKG/INF/L.116
7 October 1963
ORIGINAL : FRENCH

UNITED NATIONS

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST

Committee for Coordination of Investigations
of the Lower Mekong Basin
(Cambodia, Laos, Thailand and Viet-Nam)

STUDY OF THE ENERGY MARKET FOR HOUSEHOLD, COMMERCIAL AND INDUSTRIAL USES IN THE LOWER MEKONG BASIN

Quarterly Progress Report No. 2

by

Bernard Lefort

Project Manager of the Mekong Committee/
French Government/SOFRELEC Domestic Power
Market Survey

CONTENTS

		Page
I -	INTRODUCTION	2
II -	GENERAL DESCRIPTION OF THE WORK DONE	2
	- Cambodia	3
	- Laos	8
	- Thailand	11
	- Viêt-Nam	15
III -	ESTIMATED PROGRESS OF THE SURVEY AND GENERAL OBSERVATIONS	16

- Annex

Table of electrical energy breakdown

- oOo -

Study of the energy market for household, commercial and industrial uses in the Lower Mekong Basin

I - INTRODUCTION

The study of the energy market for household, commercial and industrial uses in the four countries composing the Committee for Co-ordination of Investigations of the Lower Mekong Basin was provided for in a Plan of Operation published as document E/CN. H/WRD/MKG/L 69 Rev.2 of 31 Octobre 1962.

The work began on 1st March 1963. It was described for the period from 1st March to 20th May 1963, in a first quarterly report. It also was described during the 21st session of the Mekong Committee.

This report describes the work done from 1st June to 30th August 1963. It also corresponds to the end of the preparatory phase of the Mission.

This initial part of the survey was aimed, after the initial contracts with the Mekong Committee and the different national and international organizations, at gathering and examining all existing material on the questions under investigation and, further, preparing the programme of investigations to be carried out in order to complete the necessary information.

The present study includes the different aspects of the work accomplished as well as the main points which have to be investigated in connexion with the continuation of the survey.

The four countries are listed in alphabetical order.

II - GENERAL DESCRIPTION OF THE WORK DONE

The collection of the data required for the survey was conducted with particular reference to:

1) the population (by age, sex, activity etc...)

/ 2) the economic

2) the economic context:

- evolution of the sectors
  - primary (agriculture)
  - secondary (mining, construction, industry)
  - tertiary (administration, trade, banking, insurance etc...)

3) the energy sector

Production, consumption, development prospects.

Generally speaking, we found the available data to be fragmentary and incomplete.

A detailed list of activities is given below:

CAMBODIA

A number of data could be gathered on the following points:

1) Population

The 1962 census illustrates the general situation at that time. The processing of the particular data is being continued. In a few months we shall be in a position to know the breakdown of the population of the Kingdom in each one of the branches of activity.

2) Agriculture - Fishing - Forests

Statistical data are fairly complete and served as a basis for determining the evolution of the sector in the past years, both for the size of the cultivated areas as for the importance of the crops and the added value of this sector.

3) Mining - Industries - Construction

Some data could be obtained on the added value of this sector until 1957. No data are available between 1958 and 1962 on the same subject or the evolution of manpower, production, and paid salaries.

4) Tertiary sector

Interesting statistical data exist for public services; they relate to the evolution of the number of the employees and paid salaries. On the other hand, information about the added value of trade and the other activities of this sector is scarce until 1957 and non-existent until now.

/ 5) Electric

5) Electric energy sector

We were able to determine, with a few imprecisions, the energy production for each province of Electricité du Cambodge and the régies (licensees), as well as the overall consumptions for Electricité du Cambodge during the last eight years.

The research work conducted during the first part of the survey on the sales invoices of Electricité du Cambodge enabled us to establish a provisional breakdown of the energy consumption for this company from 1955 to 1962. (Evolution of the number of subsribers and consumption of the following sectors:

Civil and military administration,
Lighting and power,
Lighting (private consumers),
Power. High voltage. Public lighting.

An investigation was also conducted on the breakdown of "power" consumption for a period of 3 months (February-March-April 1963) which makes it possible to gain some idea of the relative importance of the different activity branches. On the other hand, there is no statistical information for the régies (licensees), self-producers, and small concerns.

x

x x

For the implementation of the second stage of the energy market survey and to give reliable information in the final report, the services concerned will have to provide the Mission with precise data on the following points:

1) Population

As it is difficult to get precise information on the evolution of the population during the last 10 years, a number of assumptions will have to be made. These will as often as possible be checked against other data so as to give as close an approximation as possible.

/ Until

Until a future census makes it possible to follow with sufficient accuracy the population increase, it is essential that in every province birth and death be recorded with great accuracy, a list of arrivals and departures be kept.

It also would be a good thing if the processing of the data of the 1962 census could be speeded up, thus making available at an early date all information concerning the breakdown of the population (by ages, sex, occupations, urban and rural population, number of households etc...).

2) Agriculture - Fishing - Forests

Existing statistical data should be completed especially for fishing as well as fruit and vegetable crops. It also would be of interest to know the added value of this sector since 1958.

3) Secondary and tertiary sectors

It will be necessary:

- to take up again all the statistics of these sectors (with the exception of public services, for which existing data are adequate).

- to determine the added value, since 1958 and the salaries paid (since 1955) for each branch of activity, and to keep up-to-date records of these informations in the future.

It also would be advisable to establish the breakdown of the elements which, in the statistical yearbook, appear under the heading "other sectors", and withdraw the "transports" factor from the various sectors under which they currently are found.

4) Electrical Energy

It is essential to take up again since 1953 or 1954 all statistical data concerning this sector.

As regards production and consumption, it would advisable to establish statistics along the lines of the table given at the end of this report. The consumption breakdown shown in that table is in accordance with international

/standards

standards and it is to be hoped that instructions may very soon be given to Electricité du Cambodge and the licensees to start right now recording production and consumption statistics in accordance with this pattern. Should also be given: number of subscribers for each sector on the 1st January of each year; line lengths; number of transformation stations etc.

For the recording of these statistics from 1953 to 1962, the following special elements should be taken into account:

a) Electricité du Cambodge

As stated before, part the work has already been done for the period 1955-1962. We however still have to establish the breakdown for power and high voltage consumptions. This can easily be done, for almost all the factors appear in the sales invoices and only the description of the occupation of each subscriber is lacking. The 3 month investigation conducted by Electricité du Cambodge made it possible to find out in very many cases. In the future, it is essential that all new subscribers be classified according to their occupation and that the situation of the old subscribers be determined. This would make it an easy task to prepare monthly statistical returns through the perforated cards system. It would be very easy for the provinces where the number of power subscribers is very low, and a little longer for Phnom-Penh and the Kandal, which have about 700 power and high voltage subscribers.

b) Régies (Licensees)

For the station of Battambang, the requested breakdown is possible and should not entail excessive work. It should be advisable to make sure that the same goes for the other licensees, at least for the past, for in the future the taking over of most of the licensees by the Electricité du Cambodge should make things easier.

c) Small concerns

These concerns, representing about 3% of total energy sales in Cambodia are not well known but have the advantage of distributing only lighting current. An accurate list of these concerns should be established, including the installed

/ power

power, the capacity normally utilized and the number of hours of operation. This would, through a few sampling surveys, to determine the quantity of energy produced. It also would be desirable to know the number of subscribers for each concern and for each category.

d) Self-producers

An investigation is being conducted through the Direction des Mines. Considering the importance of these (40 000 kVA), it is essential to know the evolution for each of them during the period 1953-1962 and the share of lighting in overall consumption, as well as the number of families served.

e) For each of the producers and distributors of the public sector, it would also be advisable to state the following data, for each year between 1953 and 1962:

1) Length and section of the high voltage lines (including voltage, nature of the conductors as well as of the supporting structures).

2) Number of transformation stations, with the capacity of the transformers.

3) Length of the low voltage lines by section of cables and wires, nature of the conductors and of the supporting structures.

4) Technical value of the networks.

x

x x

LAOS

In the first days of June 1963, contacts were established in Vientiane with various officials and the services interested in the development of the survey.

These contacts included:

H.H. Prince Souvanna PHOUMA	- Prime Minister of the Royal Government
H.E. Keo VIPRAKONE	- Secretary of State for social affairs
H.E. Phouangkéoh PHANARETH	- President of the National Committee of the Mekong
H.E. Oukéo SOUVANNAVONG	- General Commissioner for the Development Plan
Mr. VERMEERSCH	- Assistant Commissioner
Mr. SAIGNASITH	- Director of the Department of Statistics
Mr. KHAMSING	- Director of Electricité du Laos
Mr. INTHAVONG	- Director of the Navigation & Hydraulics Department
Mr. GIRAUD	- Director of MFAET

/ The informations

The informations and statistics gathered are not very numerous. No census of the population, in the international sense, was ever taken. The figures collected are based on estimates or very localized sample surveys. There is still a certain amount of incertainty.

Regarding the 4 main classical sectors of economy, statistical information is fragmentary - the compilation is difficult. On the other hand, the general current situation makes it practically impossible to obtain overall data.

In the more special fields of external trade and of trade balance, information also is difficult to get owing to the lack of precise returns.

The evolution of the gross national income is to difficult to assess owing to the lack of information on that subject.

The questions relating to energy are easier to deal with. Electricité du Laos has,for Vientiane and a few country towns,information that can be processed. However,the past evolution is difficult to know.

o
o o

For the further development of the survey, it would be necessary for the Mission to receive further data in the fields relating:

- to natural and human factors of economy such as:
  - recent populatio.., past evolution, breakdown
  - evolution prospects of the population (overall number, geographical breakdown)
- to the economic situation
  - agriculture
  - industrial activities
  - trade - transports - services

  with the economy of those sectors:

  (assessment of added values, incomes, manpower)
- to energy

For the latter, data should,if possible,be returned according to the previously suggested pattern which makes it easy to establish a breakdown according to international standards (see annexed specimen).

o
o o

In the absence of precise information, estimates will be prepared in the light of general elements published by national and international organisms and cross-checkings often data will be made as often as possible in order to get as close a picture of the situation as possible.

o
o o

A census of existing small industries will have to be prepared by the competent authority. The capacity and the operating times of the generating motor units will have to be carefully noted.

o
o o

Private generating units are an essential item of the energy production picture. In Vientiane their number is very high. According to some estimates, the installed capacity would considerably exceed that of Electricité du Laos. A detailed list of private units must accordingly be established, including all possible information regarding daily production, the different uses, age of the generating units, estimated cost price of the kWh, fuel consumption etc..

Instructions should be given by the competent authority to make such information available as soon as possible.

o
o o

In addition to the reasearch work described above and in answer to a request by Dr. Hart Schaaf, Exeucitve Agent of the Mekong Committee, a provisional note was prepared, outlining the current situation of electricity production in Vientiane and consumption development prospects in that city immediate suburbs.

It is for the purpose of justifying the installation at an early date of an initial turbo-alternation unit in the development project of the Nam Ngum so as to ensure under the best economic conditions a reliable electricity supply in that part of Laos.

/ THAILAND

THAILAND

The activities of the Mission were mostly dedicated to the research, examination, and critical study of documents and statistics required for the survey.

As a rule, publications are numerous and prepared according to international standard. Some additional particulars will have to be sought.

Further particulars will have to be given in some cases. However, the compilation work to be done is considerable and, to carry out the survey along the same lines as for other countries, much work remains to be done considering the geographical importance of the country as well as its means.

Information was collected on the following items:

1) Population

The 1960 census had made it possible to rectify the estimates made since the preceding census in 1947. The average development rate seems to be about 3.2% per annum.

2) Agriculture

Statistical data are adequate. The evolution of this sector can be studied since 1953, in terms of the size of cultivated areas, the importance of crops and of the value of different productions.

3) Mining - Industries - Construction

Mining statistics are fairly complete. On the other hand, in the industrial and building sectors, few data are available. The evolution and the relative importance of the different activities are rather difficult to grasp.

4) Tertiary sector

Information regarding manpower and salaries paid by government services are contained in publications. However, statistics on the added value, the utilized personnel, the salaries paid by other branches of this sector are difficult to find.

/ 5) Energy sector

5) Energy sector

The currently available data provide information on the evolution of the situation in this sector until 1956 only. In some cases, particulars can be obtained for the last 3 or 4 years only.

o

o o

For the proper implementation of the second phase of the study, some tables have been prepared and distributed to the N E A representatives to be filled up. The main items of information to be collected are as follows:

1) Population

Number of births and deaths, by Changwat or, if impossible, by region, during the last 5 years so as to know as accurately as possible the actual development rate of the population figure.

A table similar to that prepared after the 1947 census and giving the figures of population groups living in communities, classified according to their numerical importance (villages under 1 000, over 1 000, 2 000, 5 000, 10 000, 20 000 inhabitants) has been requested.

2) Agriculture

It would be helpful to know the previsions made by the departments concerned, regarding:

- cultivated areas
- irrigated areas

Including, for the latter, the share devolving to pumping.

3) Construction - Industries

Investigations will have to be carried on so as to get information on the construction materials output as well as the evolution of the number of firms specialized in public works, the number of their personnel and the salaries paid by them.

The industrial survey will include food processing industries (drinks, preserves etc..); industries proper (engineering, chemicals, textiles etc..). It will be necessary to investigate the evolution of their production, the number of the industries, and the salaries paid by them.

4) Tertiary sector

Statistics for this sector will have to be taken up again, except for government services. The added value and the salaries paid will have to be determined for each branch of activity.

5) Energy

Before considering the problem of the utilization of energy, the survey will deal with the evolution of consumption of different fuels and the national possibilities for the production of fuels in their various shapes as well as prospects in this connexion.

It will be necessary to take up again production and consumption statistics, submitting them along the lines suggested in the annex (see specimen).

The processing of various publications in the field of electricity will be continued. Cross-checking of data will be regarded to and further information asked for. We already might stress that the following information will be of interest in connexion with the continuation of the survey:

- For each producer and distributor of the public and private sectors (especially for the southern provinces)

1) Lengths and sections of high voltage lines (including voltage, nature of conductors and of supporting structures).

2) Number of transformation stations and capacity of the transformers.

3) Lengths, by section of wires and cables, of low votage lines; nature of conductors and of supporting structures.

4) Technical value of the networks.

Apart from the activities described above, there were talks with different officials including:

- Mr. H.S. JACOBSON - USGS Economist geologist.

/ This expert

This expert mentioned the int resting mining possibilities of the region of LOEI. Although the real importance of the deposits is not yet exactly known, the prospects of utilization of electrical energy in that area, at a short distance of the Mekong river, are of great interest. Further interviews will take place with a view to following the developments of the survey which is being conducted as well as taking into account the possibilities of expansion electric consumption.

- Mr. LYLE W. MABBOTT - Chief Pamong Project (USAID)

A first delegation of experts of this organization came to conduct the investigations provided for in the agreement concluded with the Mekong Committee for the Pamong Project.

The purpose of this meeting, organized at the request of the N E A with a view to finding the kind of information which should be made available to USAID under chapter 4 g a (collection of information relating to the energy market, uses, rates, prospects regarding the consumption increase etc...).

Contacts will be maintained with the delegation as the survey progresses so as to ensure co-ordination and ascertain the lines along which further research work should be conducted to ensure a parallel development of the surveys.

Mr. Sai NIDHINANDA, Director of the P E A

This first contact was for obtaining general information on production and consumption of electricity in the provinces.

o
o o

During the month of August, a first visit in 6 changwats of the North-Eastern regions (Khonkan, Udornthani, Nongkai, Sakornakhorn, Kalasin, Mahasarakham) and in a few amphurs yielded more precise information on the economy of those provinces as well on the situation of electricity production and distribution.

A more thorough knowledge of the situation of the small industry was acquired in the course of this visit. Similar visits will be made in the 3 other regions of the Kingdom.

/ VIET-NAM

VIET-NAM

Activities centered upon the analysis of documents gathered during the visit of May 1963.

In general, those documents, although interesting, are not adequate The investigation will have to be extended locally with the help of different government services through the co-director of the Project.

1) Population

In the absence of a general census, numerous investigations and much cross-checking will be needed. On the other hand, further particulars should be obtained on the number of inhabitants of the newly created villages.

2) Agriculture - Fishing - Forests

Statistical elements will have to be completed especially for fishing and food crops.

It also would be interesting to know the evolution of the added value in this sector in the past.

3) Secondary and tertiary sectors

The statistics of these sectors will be taken up again, research centering upon the economy of the different branches. The added values, the salaries paid etc... will inter alia have to be determined.

4) Elec rical energy

The data obtained are insufficient. The distributing companies will have to be approached to get particulars on the evolution of energy production and consumption during the last 10 years as well as the structure of networks.

The statistical elements wanted will have to be submitted along the previously mentioned lines (see annexed specimen).

o

o o

/ In September

In September, a new visit will be made in Viêt-Nam with a view to studying the details of the future organization of the Mission. Before the end of the next quarter, an engineer will be specifically appointed to follow the work until the preparation of final report.

III. ESTIMATED PROGRESS OF THE SURVEY AND GENERAL OBSERVATIONS

CAMBODIA

The percentage of completion can be estimated at 30 %

LAOS

The percentage of completion is about 20 %

THAILAND

The percentage of completion can be estimated at 30 %

VIET-NAM

The percentage of completion is about 15 %

o

o o

This report, at the same time as it describes the progress made includes a number of recommendations on the additional information to be made available to the Mission by the representatives of each of the 4 countries.

It is essential that the new information requested should be rapidly be made available so that the survey may be pursued under the best conditions.

Direct contacts will be established with the co-directors with a view to working out the details of the work.

o

o o

A N N E X

ELECTRICAL ENERGY BREAKDOWN

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
1. PRODUCTION - EXCHANGE										
1.1 ELECTRICAL PRODUCTION										
- Primary hydraulic energy (Energy corresponding to ...80% of the water going through the turbines)										
- Gross overall thermal production of which:										
- public sector supply										
- private sector supply (self-producers) ...										
breakdown also according:										
- electrical energy produced from:										
coal										
lignite										
wood										
petroleum products										
TOTAL ELECTRICAL PRODUCTION										
1.2 BALANCE OF THE EXCHANGES WITH FOREIGN COUNTRIES										
1.3 OVERALL DOMESTIC CONSUMPTION										

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
2. BREAKDOWN OF THE OVERALL DOMESTIC CONSUMPTION										
2.1 Unrecorded consumption and losses										
Consumption by:										
- power stations										
- losses in distribution										
2.2 Consumption breakdown by branch of activity										
- transports (railways, street cars, harbour installations etc...										
- industries:										
- mining										
- metal - engineering										
- chemical products (paint, varnishes, soap etc..)										
- construction material (bricks, tiles, cement etc..)										
- food processing										
- construction building										
- textile (clothing, leather, rubber etc..)										
- wood, furniture, paper										
- Miscellaneous										

	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962
- household sector :										
lighting										
power										
cooking										
- trade, banking, insurance, private services										
- public services (civilian and military)										
- public lighting										
- agriculture (pumping, rice husking factories etc..)										
- miscellaneous										

LIMITED
WRD/MKG/INF/L.117
15 October 1963

ORIGINAL : FRENCH

UNITED NATIONS

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST.

Committee for Coordination of Investigations
of the Lower Mekong Basin.
(Cambodia, Laos, Thailand and Viet-Nam)

MIXING OF THE WATERS AT THE SNOC TROU BAR IN FLOOD PERIODS

by

J.P. CARBONNEL
Sedimentologist

GEOGR.PHIC.L CONDITIONS

Before flowing into the Great Lake, the Tonlé Sap flows through a largely fossil deltaic formation: the Snoc Trou Bar. This where it is joined by one of the main tributary rivers of the Great Lake: the Stung Sen (see Table 1).

We only studied the Eastern part of the Bar, as it is the only section involved as far as the Stung Sen water is concerned and also because most of the water flows through it in flood periods.

.lmost parallel and oriented North-South, seven "preks"[1/] connect the Tonlé Kramon (as this part of the Tonlé Sap is called) with the Great Lake. Starting from the northernmost, they are: Preks T.SOM, R.TNAM, R.T TU, R.T B., R.T NHI, R.T NHUT, T.MEN - It should be added that Prek T.SOM is the only link with between the Tonlé Sap and the Great Lake in low water periods. Further south is the STUNG SEN, the mouth of which is encumbered by two islands.

To simplify things, we numbered the preks 1 to 7. Nos.8 and 9 are STUNG SEN and Tonlé Kramon, respectively.

1/ The word "Prek", in the Cambodian language, denotes a channel connecting the river with back ponds, or "beng". Here, the Great Lake is considered as the "Beng Thom" (Great Beng), the Tonlé Sap being the prek which connects it with the Me.eng river.

SAMPLINGS

On 11 July 1962, as the Tonlé Sap and the Stung Sen were at high flood level (reaching the 4 m 68 mark at the Snoc Trou gage) we took surface and bottom samplings of the water of the different preks, of the Stung Sen and the Tonlé Kramon (for the latter on both sides of the island facing Snoc Trou). The surface samplings were always taken 50 cm below the surface and the bottom samplings about 75-100 cm from the bottom.

Temperature was taken by means of a Métrix thermometric sounding device. The Institut Pasteur laboratory in Phnom-Penh tested the samples for the following: pH; resistivity, turbidity; dry residual matter at 100° C; suspended matter content; alcalinity; hardness; Ca^{++}; Fe^{++} .

The results of these tests are shown in table No.1.

RESULTS

The first striking fact is the great difference between the water of Tonlé Sap and the water of Stung Sen.

The Tonlé Sap water is characterized by a basic pH (7, 5-7, 6) and a comparatively low resistivity (7000 Ω/Cm^2). The Stung Sen water, on the other hand, has a slightly acid pH (6, 8-6, 9) and a great resistivity (34.500 Ω/Cm^2).

These characteristics are sufficient to tell the one water from the other, as they exist on the surface as well as near the bottom. The suspended matter content also differs greatly: it is much higher in the Stung Sen. Moreover, the latter has a very high suspended matter content gradient, which does not seem to be the case for the Tonlé Sap.

Alcalinity and hardness also are very different as well as the Ca content. The Stung Sen has almost three times more iron than the Tonlé Sap. Despite those very marked differences, it must be noted that the difference between 100° residual and suspended matter (which gives the dissolved salts content) is practically the same for the two rivers.

Let us straightaway observe that the seven preks through which the waters of the Tonlé Sap and the Stung Sen flow have physico-chemical characteristics the values of which are intermediate between those of the two rivers. Their water therefore is the result of certain mixing between the waters of these two rivers. The problem consequently is to determine the proportions of the mixing and whether the two types of water preserve their identity.

To illustrate this fact, we prepared charts in which the ordinates show the figures for the physical or chemical characteristics of the water, and the abscissae the different preks and the original waters. At both ends of the abscissae are plotted the measurements corresponding to the Tonlé Sap and the Stung Sen, respectively. Between them, the seven preks, beginning by the most distant, which is Prek Tasom (No.1).

If the mixing were perfect, the variation curve of each characteristic should be regular as one goes from the Tonlé Sap to the Stung Sen. The surface waters curve is coupled with the bottom waters curves (dotted line) see Fig 2

INTERPRETATION

The first fact resulting from an examination of the curves of the second chart is the small difference between the composition of the water of the Tonlé Sap (9) and the composition of the water of preks 1, 2, 3 and 4, whether at deep or surficial levels. Practically, allowing for the errors in analysis as well as for the comparative heterogeneousness of the waters in a vertical cross-section, because of turbulence, no water except that of the Tonlé Sap flows through those preks. The variation curves of alcalinity and hardness are significant in this respect.

At the other extremity of those curves, the same thing can be observed for preks 6 and 7 and the Stung Sen (8). Through these two preks, practically no other water than that of the Stung Sen seem to flow. Thus, as they come forth into the Tonlé Kramon, they form an almost closed loop to directly and individually join the Great Lake.

The case of prek 5 is more difficult. For the variation curves, at its level, instead of following the general pattern of the preceding sections, peak up towards values similar to those of the Stung Sen and sometimes even identical (especially as regards pH).

Things, in every respect, look as if the waters most closely reflecting the composition of those of the Stung Sen, instead of flowing through the two preks next to it, flowed through prek 5; in other words, that the Stung Sen stream followed a curve going from the mouth of the Stung Sen to the mouth of prek 5, and that the waters flowing preks 6 and 7 already were the result of a mixing.

CONCLUSIONS

The limited number of our analyses does not warrant any further deductions. One thing, however, seems certain: i.e. the individuality of the two waters arriving at the level of the Snoc Trou Bar. The water of the Stung Sen is pushed north by the Tonlé Sap and the two waters do not mix. Next, most of the Stung Sen water flows through prek RAT NHI (5).

These conclusions are valid only for the time at which this survey was conducted, for the respective hydrological conditions of the Stung Sen and the Tonlé Sap vary each year and often not synchronically: the Tonlé Sap flood depends upon the Mekong flood, whereas the Stung Sen flood depends on the more or less early arrival of the rainy season in the river watershed.

The time-lag between the respective floods of the two rivers is not always the same each year.

A late rainy season (1963), because it delays the Stung Sen flood, will give the advantage to the water of the Tonlé Sap and this flood will not be felt at the Snoc Trou Bar, because the influence of the water of the Tonlé Sap will be too great. Thus, the transfer of the Stung Sen water toward the Great Lake will take place further upstream from its mouth as the time-lag between the two flood increases.

This is very important; the obliteration of the Stung Sen water by the Tonlé Sap water at a greater or lesser distance from the Tonlé Kramon makes for or against the discharge of sand into the Snoc Trou Bar.

However, the fact which we brought into light in 1962 (flowing of the Stung Sen through prek 5) must be fairly usual and general, at least in the early stages of the flood; for we found during the low-water period of 1963 that at level of prek 5 there was across the Tonlé Kramon a silt bar about 1 m high. This bar can only be explained by the deposit, through flocculation, of suspended matter contained in the water of both rivers at the place of their confluence. This bar must in addition develop further during the ebbing of the water as a big fishing dam ("thos" in Cambodian language) is installed every year by the fishermen across the Tonlé Kramon at the level the island between preks 4 and 5.

The study of the bottom solid transport of the Stung Sen, started this year by the Vienna Atomic Energy Agency, will provide further precise data on the subject and will extend these results to the more specific problem of sand transport.

September 1st, 1963

J.P. CARBONNEL

Table No. 1
Tableau No. 1

ANALYSES PREKS		Temperature Température		p H		Resistivity Résistivité om		Turbidity Turbidité cm		Residue Résidu 100 °		Suspended matters Matières en suspension		Alcalinity Alcalinité Co_3Ca		Hardness Dureté Co_3Ca		Ca		Fe		Dissolved salts Sels dissous	
		Surf. Surf.	Bottom Fond	Surf. Surf.	Bott. Fond	Surf. Surf.	Bottom Fond	Surf. Surf.	Bott. Fond	Surf. Surf.	Bottom Fond	Surf. Surf.	Bottom Fond	Surf Surf	Bott Fond	Surf. Surf	Bott Fond	Surf. Surf.	Bottom Fond	Surf. Surf	Bott. Fond	Surf. Surf.	Bottom Fond
Prek TASOM	1	30°05	30°00	7,5	7,3	7.272	7.488	15	16	132	122,4	48	45,6	53	52	54	52	16,8	16	0,8	1,2	84	76,8
Prek RATNAM	2	29°90	29°90	7.3	7.1	8.352	9.216	15	11	151,2	175,2	66,4	97,6	48	45	50	44	16	12,8	0,7	1,4	84,8	77,6
Prek RAT TU	3	29°15	29°30	7,4	7,4	8.062	7.632	18	16	152	157,6	59,2	72	49	51	52	54	16	16,8	1,2	1,0	92,8	85,6
Prek RAT BA	4	29°20	29°20	7.2	7,3	7.992	7.920	14	15	160,8	162,4	72	77,6	49	49	50	50	16	16,2	0,9	1,3	88,8	84,8
Prek RAT NHI	5	29°20	29°20	6,8	6,9	15.840	14.400	14	14	199,2	199,2	121,6	117,6	27	30	28	30	8	8,8	1,5	1,4	77,6	81,6
Prek RATNHUT	6	29°20	29°20	7,1	7,1	9.720	10.368	14	15	170,4	163,2	84,8	86,4	41	38	42	38	12,8	12	1,2	1,2	85,6	76,8
Prek TAMEN	7	29°70	29°80	6,9	7,1	16.560	44.640	7	7	239,2	296	155,2	205,6	26	18	24	18	7,2	4,8	1,8	1,6	84	90,4
Stung SEN	8	29°40	29°40	6,8	6,9	34.560	34.560	10	6	368	674,4	292	545,6	13	13	12	12	3,2	3,2	2,0	3,3	76	128,8
Tonlé KRAMON	9	29°90	29°90	7,6	7,5	6.984	6.984	13	13	152	163,2	73,6	56,8	55	56	58	60	18,4	19,2	0,7	1,6	78,4	106,4
Face SNOC TROU	10	29°90	-----	7,5	---	7.704	-----	14	—	138,4	———	48	-----	51	--	54	—	16	———	0,7	—	90,4	———
Forêt inondée	11	-----	-----	6,9	---	8.640	-----	35	28	98,4	100,8	19,2	20,8	47	47	48	46	14,4	13,6	1,1	1,1	89,2	80

VARIATIONS DES CARACTERES PHYSICO-CHIMIQUES

VARIATION OF THE PHYSICO-CHEMICAL

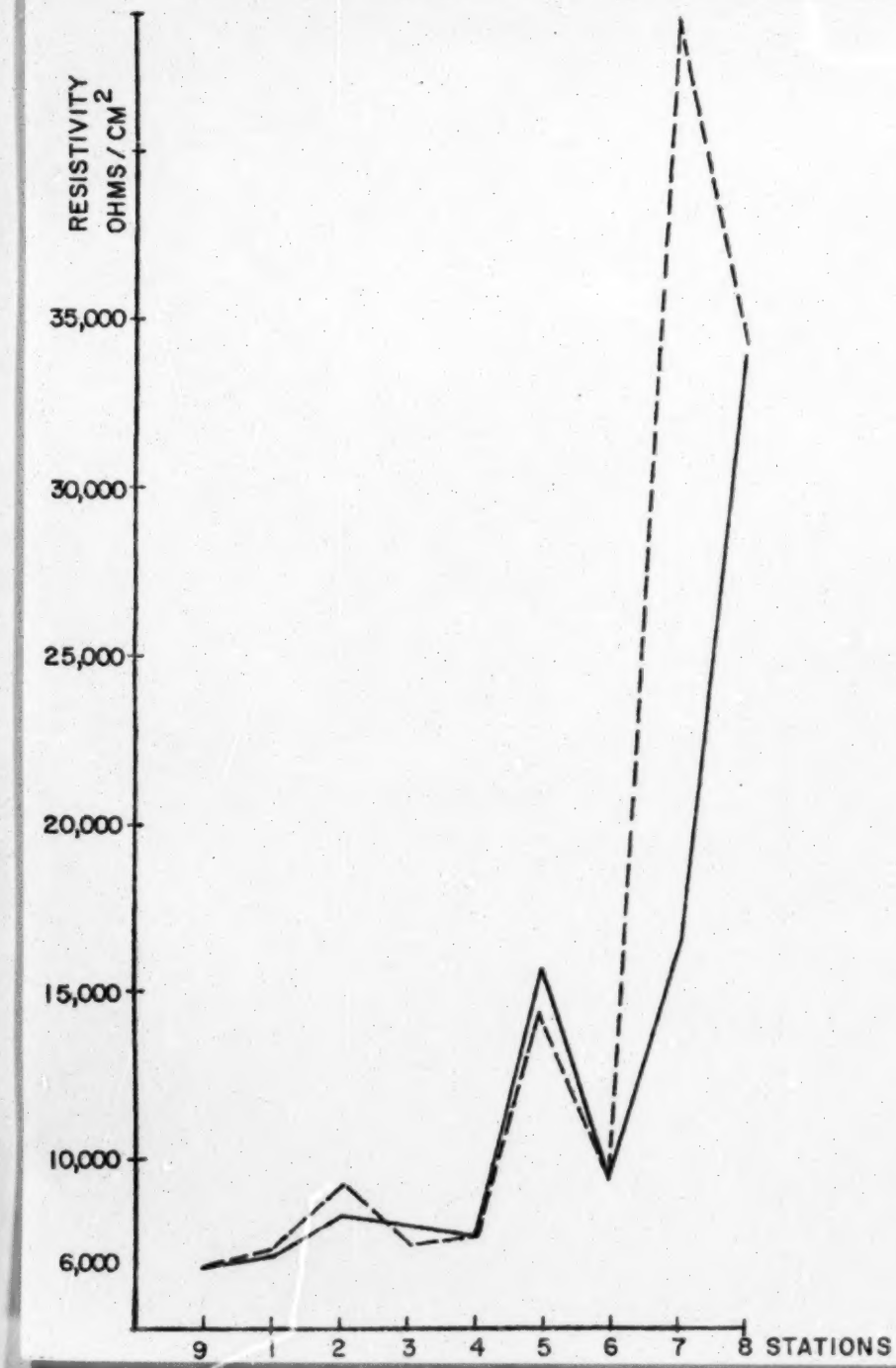
DES EAUX DU SEUIL DE SNOC TROU EN PERIODE

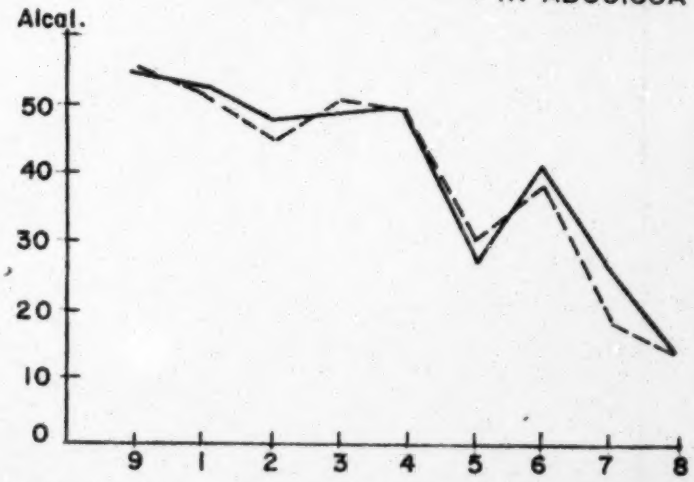
CHARACTERISTICS OF THE WATER OF THE

DE CRUE EN ABSCISSE

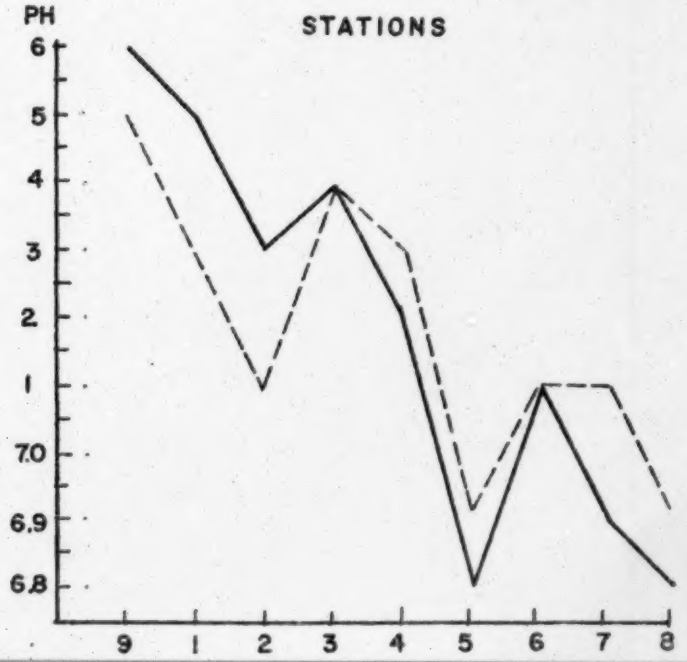
SNOC TROU BAR IN FLOOD PERIODS

IN ABSCISSA





1 PREK TASOM
2 " RATNAM
3 " RAT TU
4 " RAT BA
5 " RAT NHI
6 " RAT NHUT
7 " TAMEN
8 STUNG SEN
9 TONLE SAP



VARIATIONS DES CARACTERES PHYSICO-CHIMIQUES

VARIATION OF THE PHYSICO-CHEMICAL

DES EAUX DU SEUIL DE SNOC TROU EN PERIODE

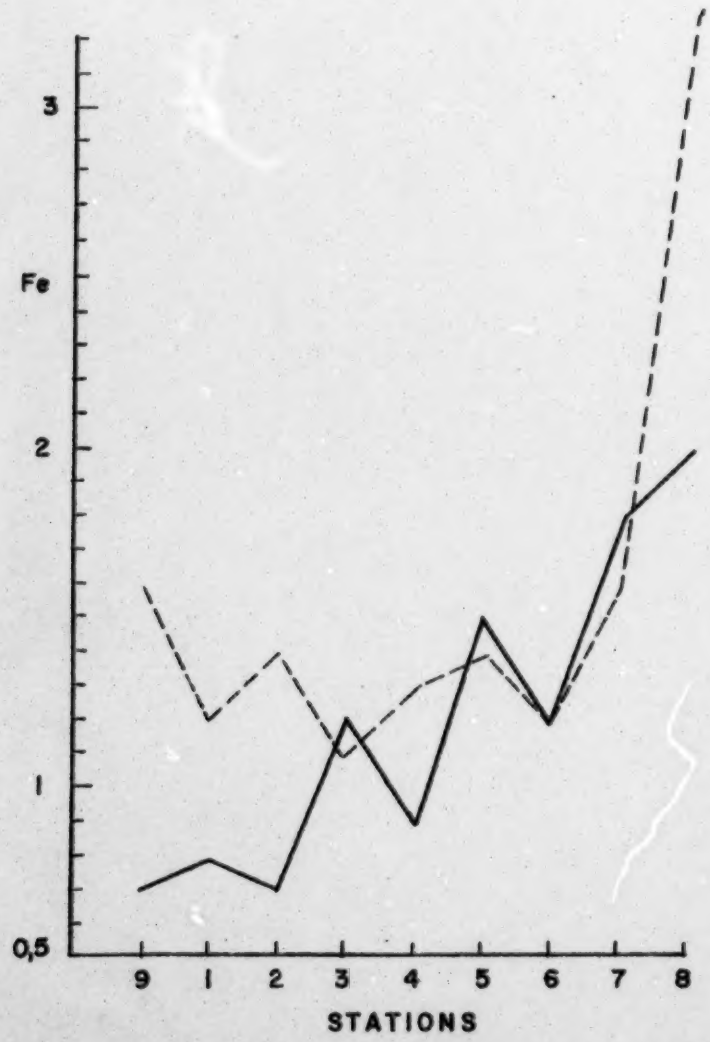
CHARACTERISTICS OF THE WATER OF THE

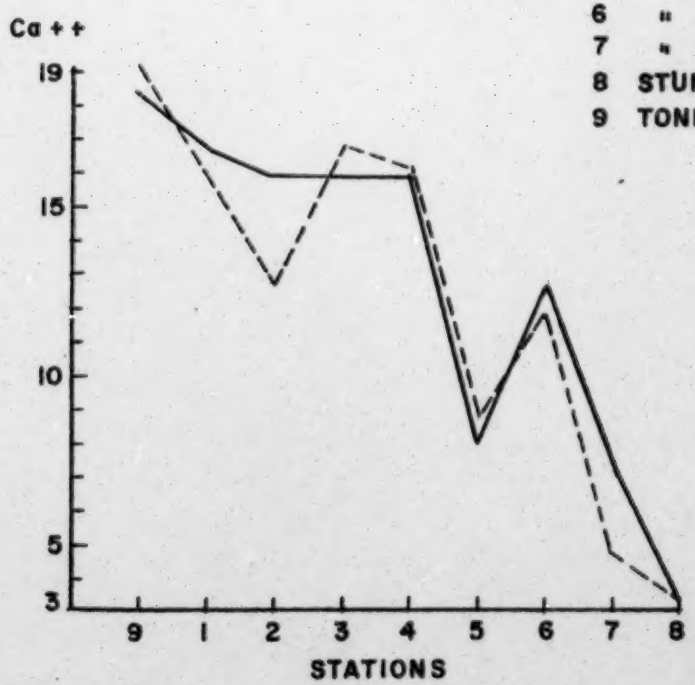
DE CRUE EN ABSCISSE

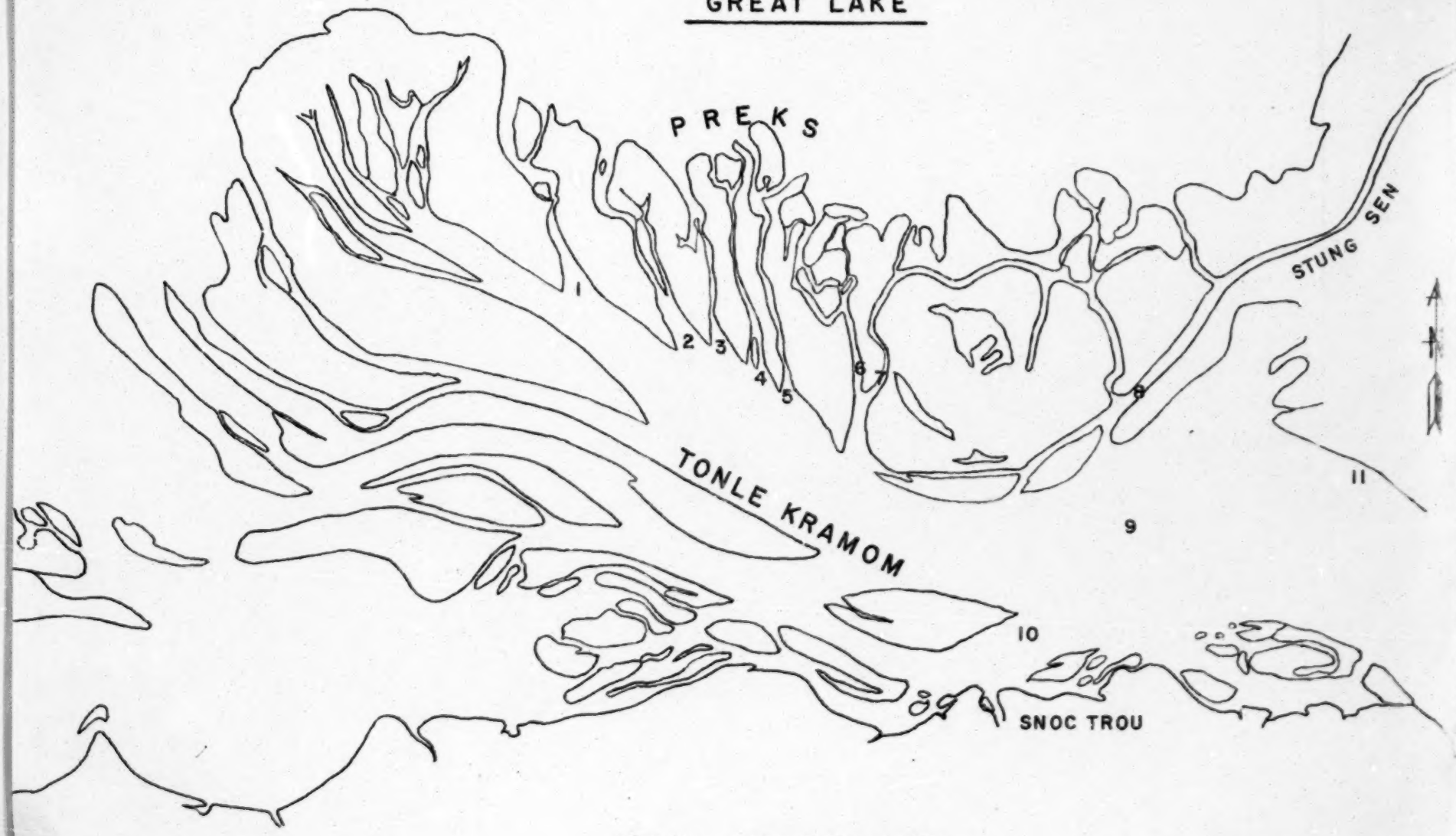
SNOC TROU BAR IN FLOOD PERIODS

IN ABSCISSA

1 PREK TASOM
2 " RATNAM
3 " RAT TU
4 " RAT BA
5 " RAT NHI
6 " RAT NHUT
7 " TAMEN
8 STUNG SEN
9 TONLE SAP







SEUIL DE SNOC-TROU

POINTS DE PRELEVEMENTS D'EAUX

WATER SAMPLING POINTS